

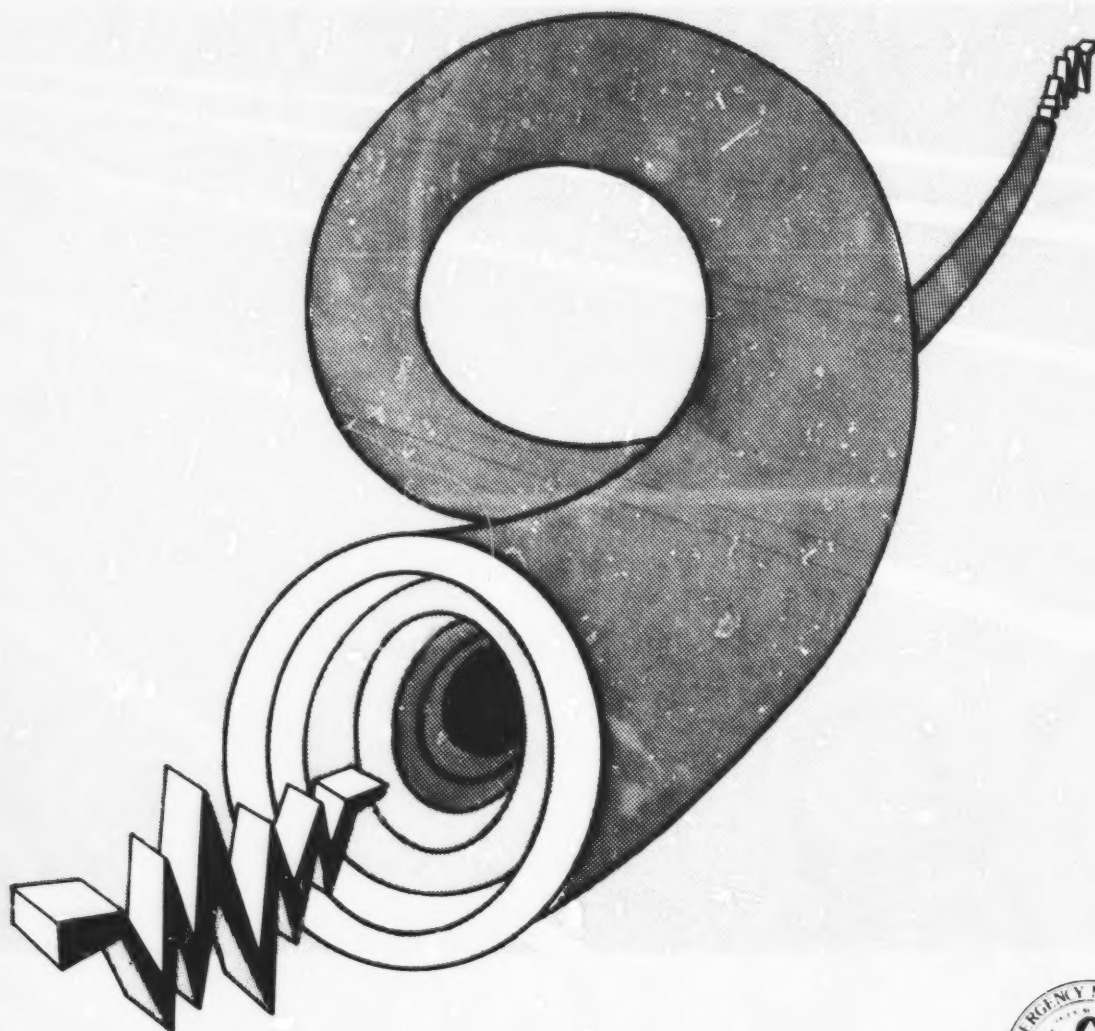
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Maintenance Manual Radio Transmission Lines



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MAINTENANCE MANUAL

RADIO TRANSMISSION LINES

**Federal Emergency
Management Agency**

Maintenance Manual Radio Transmission Lines

Introduction

The purpose of this manual is to guide you on how to maintain radio transmission lines. The information in this manual is only a **supplement** to the recommended maintenance information contained in the manufacturer's service manual. **Always follow the maintenance procedures described in the manufacturer's manual.** This manual will help you understand why maintenance is necessary. This manual will also be helpful if the manufacturer's manual is not immediately available.

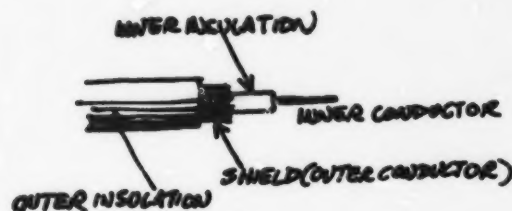
Description of Radio Transmission Lines

Radio transmission lines are made up of a series of coaxial cables. A coaxial cable consists of four parts: (see figure 1).

- 1) inner conductor,
- 2) inner insulation,
- 3) outer conductor, and
- 4) outer insulation.

The inner conductor carries the radio waves from the antenna to the transmitter/receiver. It is usually made out of solid or stranded copper. In high power coaxial cables, the inner conductor is made out of a copper tube. The inner insulation is made from synthetic materials such as polyethylene, teflon, or polyform. The outer conductor consists of braided copper. It acts to contain the radio waves in the inner conductor. The outer insulator protects the inner layers from weather and normal hazards.

Figure 1



When radio transmission lines are longer than 100 ft., a rugged coaxial cable called hardline is used. Hardline is a coaxial cable with a solid outer shield; it ranges in thickness from 0.5 in. to 3 in.

There are two properties of radio transmission lines that are important to understand in order to decipher problems that may occur. These properties are called standing waves and velocity.

Standing waves are a form of interference created when the transmission line is not properly terminated. A portion of the radio signal is actually reflected back along the line. A standing wave is also known as a voltage standing wave (VSW). High VSW will interfere with the receiver by reducing its effective power. With a device called a rf through-line watt meter, you can measure the voltage standing wave ratio (abbreviated as VSWR) in an antenna and determine if the interference is being caused by the antenna or the coaxial cable.

The second property is the attenuation, or loss figure in decibels per hundred feet. Since transmission losses increase with the frequency used, low-loss cables should be used for long runs and particularly in vhf-band systems. The following table illustrates these properties.

<u>Type of cable</u>	<u>d/b loss per 100 ft.</u>	
	<u>100 MHz</u>	<u>4GHz</u>
RG- GA/U	2.7	31.0
RG-8A/U	1.9	18.0

Preventive Maintenance

To ensure that the transmission line works in an emergency, **regularly check the cable to spot small troubles before they become big problems.** Semiannual and biennial maintenance checks prevent serious problems from suddenly happening.

Routinely inspect the transmission line. Check for frayed connections and damage to the cable. These checks are not normally mentioned in manufacturer's manuals, but can lead to more serious problems.

Equipment and Spare Parts

Only ordinary mechanical and electrical tools are necessary to keep your transmission line in top shape. More detailed maintenance activities require the following tools:

ohmmeter
oscilloscope
rf through-line watt meter.

Radio transmission lines require few spare parts. Because the cost of coaxial cable is low, completely replacing a faulty transmission line is preferred to a time-consuming search for a problem with a line. The following table gives an example of what one agency, with several fixed station antennas, keeps on hand for emergencies.

Spare Parts: Radio Transmission Lines

<u>Names of parts</u>	<u>Quantity</u>
transmission lines	100 ft.
recommended male connectors	8
recommended female connectors	8
anticorrosion silicone compound	1 pint

Safety

Radio transmission lines carry high voltages. Do not inspect the transmission line when the transmitter is operating. Do not work near a transmission line when the transmitter's power is on; particularly avoid the area around the antenna coupler. In any case, contact can be fatal and inflict severe burns. Only a qualified electronics technician should attempt to repair any serious electrical problems. Follow safety precautions outlined in maintenance manuals provided by the manufacturer.

6-Month Maintenance Checks

- 1) Inspect line for cuts, kinks, breaks, crushing, fraying, and improper positioning.
- 2) Make sure all connections are watertight. Apply anticorrosion silicone compound if the connections are not watertight.

24-Month Maintenance Checks

- 1) Check velocity standing wave resistance (VSWR) of transmission lines. Consult manufacturer's manuals to insure that it is within specifications.
- 2) Check continuity of outer conductor using meter.
- 3) Check transmission lines.

Corrective Maintenance: Troubleshooting

Some equipment malfunctions may be discovered during the operation or maintenance of the communication system. You should perform the tests on the following table to correct the problem.

PLEASE NOTE: This manual does not attempt to list all possible malfunctions that could occur nor can we suggest all possible remedies. Consult the manufacturer's manual if a malfunction is not listed or it is not corrected by a prescribed procedure.

Malfunction	Possible Cause	Recommendation
1. No transmission	☐ break in transmission line	☐ replace line
	☐ broken connector	☐ replace connector
2. Short transmission range	☐ leaky insulation	☐ replace cable
	☐ high VSWR	☐ adjust tuning controls of receiver or antenna length
		☐ inspect transmission line for nicks or crimps
3. Normal range, noisy reception	☐ transmission line picking up other signals	☐ reroute transmission line
	☐ break in outer shield	☐ replace line